

Having thus described the preferred embodiments,  
the invention is now claimed to be:

1. A method for calibrating a coincidence imaging  
system which includes a plurality of radiation detectors,  
5 the method comprising:  
measuring a plurality of coincidence radiation events  
associated with a point radiation source;  
assigning initial values for a set of fitting  
parameters;  
10 applying a minimization algorithm including:  
calculating lines of response (LOR) based  
upon the fitting parameters and the  
measured radiation events,  
generating a figure of merit characterizing  
15 the apparent size of the point  
radiation source based upon the LOR's,  
and  
optimizing the fitting parameters to  
produce a minimized figure of merit;  
20 and  
extracting from the optimized fitting parameters a  
correction factor relating to a positional  
coordinate of a detector.
2. A method for imaging using a plurality of  
25 radiation detectors, the method comprising:  
measuring a plurality of coincidence radiation events  
associated with a point radiation source;  
assigning initial values for at least one fitting  
parameter;  
30 calculating lines of response (LOR) based upon the at  
least one fitting parameter and the measured  
radiation events;  
generating a figure of merit characterizing the  
apparent size of the point radiation source  
35 based upon the LOR's;

optimizing the at least one fitting parameter using  
a minimization algorithm which includes  
iteratively repeating the calculating and  
generating steps to produce a minimized figure  
5 of merit;  
extracting from the at least one optimized fitting  
parameter at least one correction factor;  
acquiring a set of radiation data from an associated  
subject;  
10 correcting the radiation data for camera misalignment  
by correcting the spatial coordinates of the  
detected radiation events using the at least one  
correction factor; and  
reconstructing an image representation from the  
15 corrected radiation data.

3. The imaging method as described in claim 2,  
wherein the at least one fitting parameter includes:  
a parameter related to the radial positional  
coordinate of a detector.

20 4. The imaging method as described in claim 2,  
wherein the at least one fitting parameter includes:  
a parameter related to the tangential positional  
coordinate of a detector.

25 5. The imaging method as described in claim 2,  
wherein the at least one fitting parameter includes:  
a parameter related to the orientational positional  
coordinate of a detector.

30 6. The imaging method as described in claim 2,  
wherein:  
the step of generating a figure of merit includes  
summing a distance of closest approach of each  
LOR to a spatial point; and

the at least one fitting parameter includes the positional coordinates of the spatial point.

7. The imaging method as described in claim 2, wherein:

5 the step of generating a figure of merit includes summing the square of a distance of closest approach of each LOR to a spatial point; and the at least one fitting parameter includes the positional coordinates of the spatial point.

10 8. The imaging method as described in claim 7, wherein the step of generating a figure of merit further includes:

discarding LOR's whose distance of closest approach is greater than a preselected distance.

15 9. The imaging method as described in claim 2, wherein the step of generating a figure of merit further includes:

obtaining a crossing point of each pair of LOR's; and calculating a standard deviation of the crossing points.  
20

10. The imaging method as described in claim 2, wherein the step of generating a figure of merit further includes:

obtaining a distance of closest approach for each pair of LOR's; and  
25 calculating a standard deviation of the obtained distances.

11. The imaging method as described in claim 2, wherein the number of detectors is N and the fitting parameters include:  
30

$\Delta r_i$ ,  $i=1$  to N, where  $\Delta r_i$  is a correction for the radial coordinate of the  $i$ th detector;

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$\Delta t_j$ ,  $j=1$  to  $N$ , where  $\Delta t_j$  is a correction for the tangential coordinate of the  $j$ th detector; and  $\Delta \theta_k$ ,  $k=2$  to  $N$ , where  $\Delta \theta_k$  is a correction for the orientational coordinate of the  $k$ th detector.

5        **12.** The imaging method as described in claim 11, wherein the fitting parameters further include:  
positional coordinates of the point radiation source.

10        **13.** A method of PET imaging comprising:  
coincidence detecting radiation events from a  
calibration source with at least two detector  
heads;  
calculating correction factors that correct for  
mechanical misalignment of the detector heads  
from the coincidence detected calibration source  
15        radiation;  
during a diagnostic imaging procedure performed on a  
subject, generating image data in response to  
radiation collected with the detector heads;  
correcting the image data with the correction  
20        factors; and  
reconstructing the corrected image data into an image  
representation.

25        **14.** A coincidence imaging system comprising:  
a gantry;  
a plurality of flat panel detectors disposed about  
the gantry;  
a data memory which stores measured data about  
radiation events detected by the detectors;  
a calibration memory which stores a plurality of  
30        calibration parameters for correcting data  
measured during a patient scan; and  
a processor in communication with the calibration  
memory and with the data memory which calculates  
the calibration parameters by a minimization

algorithm that includes optimizing fitting parameters with respect to acquired radiation data associated with a point radiation source.

5       **15.** The imaging system of claim **14** wherein the minimization algorithm further includes:  
calculating lines of response (LOR) based upon the fitting parameters and the measured data;  
generating a figure of merit characterizing the  
10       apparent size of the point radiation source based upon the LOR's; and  
optimizing the fitting parameters to produce a minimized figure of merit.

15       **16.** The imaging system of claim **15** wherein the calibration parameters include:  
parameters relating to positional coordinates of the plurality of detectors.

20       **17.** The imaging system of claim **16**, wherein:  
the gantry is a rotatable gantry which acquires measured data over a range of gantry angular positions.

25       **18.** The imaging system of claim **14**, wherein:  
the figure of merit is generated by summing the square of a distance of closest approach of each LOR to a spatial point; and  
the fitting parameters include the positional coordinates of the spatial point.

30       **19.** The imaging system of claim **14**, wherein the generating of the figure of merit includes:  
obtaining a crossing point of each pair of LOR's; and  
calculating a variance of the crossing points.

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20. The imaging system of claim 14, wherein the minimization algorithm further includes:

discarding measured data about radiation events whose energy is outside a preselected energy range.

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